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NPTEL

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Unit 15 - Week 9: Fundamental properties of feedback systems

Course outline

How to access the portal

Prerequisite Assignment

MATLAB Download and Introduction

MATLAB Learning Modules

Week 1: Linear System Theory, Fourier and Laplace Transforms

Week 2: Introduction to feedback control, Nyquist stability theory

Week 3 : Bode plots, Steps for performing control design, General controllers

Week 4: Bode-plot and root-locus based control design

Week 5: Control of systems with some known parameters, Introduction to 2-degree of freedom control

Week 6: 2-Degree of

Week 9 - Assessment

The due date for submitting this assignment has passed. Due on 2018-10-03, 23:59 IST.
As per our records you have not submitted this assignment.

1) The loop gain L of a unity feedback system is   *1 point*

$$L(s) = \frac{1}{(\frac{s}{100} + 1)(\frac{s}{200} + 1)(\frac{s}{300} + 1)}$$. Further, it is given that, $\oint_{C=C_1+C_2} \ln S ds = 0$ where

S is the sensitivity function and C is closed curve in the s-plane shown below:

Identify the correct equation.

○ $\int_{C_2} \ln S ds = \pi$

○ $\int_{C_1} \angle S ds = 2\pi$

○ $\int_0^\infty \ln |S| d\omega = 0$

○ $\int_0^\infty S ds = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\int_0^\infty \ln |S| d\omega = 0$

2) The natural logarithm of the sensitivity function S as a function of frequency(ω) for a   *1 point*
minimum-phase, stable system is shown below:

Calculate the value of $\int_\pi^\infty \ln |S| d\omega$:

○ $\pi/2$

○ π

○ $3\pi/2$

○   0

No, the answer is incorrect.
Score: 0

Accepted Answers:

π

3) The Bode plot for the open loop gain of a unity feedback system is shown below:　　　*1 point*

Identify the approximate values of open-loop phase for $\omega \ll 10 \; and \; \omega \gg 10$.

○

$0 \; and \; -\pi \; respectively.$

○

$0 \; and \; -\pi/2 \; respectively.$

○

$-\pi/2 \; and \; -\pi \; respectively.$

○

$-\pi \; and \; -\pi/2 \; respectively.$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$0 \; and \; -\pi \; respectively.$

4) Calculate the approximate value of open-loop phase at $\omega = 1 rad/s$ for the system　　　*1 point*
specified in Q3.

○

$\dfrac{-3}{5\pi}$

○

$\dfrac{2}{5\pi}$

○

$\dfrac{-2}{3\pi}$

○

$\dfrac{-2}{5\pi}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\dfrac{-2}{5\pi}$

5) What information does the ideal bode characteristic plot give?　　　*1 point*

○ The minimum necessary gain and phase margins.

○ The maximum possible gain cross-over frequency.

○ The minimum possible gain cross-over frequency.

○ The optimal relative degree of the loop gain.

No, the answer is incorrect.
Score: 0

Accepted Answers:
The minimum possible gain cross-over frequency.

6) The open-loop magnitude for a plant P(s) has to be maintained at 40 dB for frequency　　　*1 point*
$\omega \le 10 \; rad/s$. Further, it is required that the phase margin should be $\dfrac{\pi}{4}$. Calculate the minimum value
of gain cross-over frequency:

○ 30 rad/s

○ 107 rad/s

○ 39 rad/s

○ 76 rad/s

No, the answer is incorrect.
Score: 0

Accepted Answers:
107 rad/s

7) Identify the ideal bode characteristic for the loop gain L(s)=CP(s) obtained in Q6 from the   ***1 point***
options given below:

- ○
- ○
- ○
- ○

No, the answer is incorrect.
Score: 0

Accepted Answers:

8) In a certain feedback control system, it is desired to maintain the loop gain constant at 75 dB ***1 point***
up to 43 rad/s. The phase margin of the system should be $40°$ and gain margin should be 10 dB.
Determine the value of requisite roll-off (in dB/decade) after 43 rad/s that would lead to minimum gain
cross-over frequency.

- ○ -31.11 dB/decade
- ○ 31.11 dB/decade
- ○ -41.11 dB/decade
- ○ -15.55 dB/decade

No, the answer is incorrect.
Score: 0

Accepted Answers:
-31.11 dB/decade

9) For Q8, find out the frequency (ω'_{gc}) till which the slope should be maintained to obtain the   ***1 point***
required Gain margin.

- ○
  $65.0 \times 10^3 \ rad/s$
- ○
  $75.2 \times 10^3 \ rad/s$
- ○
  $20.8 \times 10^3 \ rad/s$
- ○
  $11.6 \times 10^3 \ rad/s$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$11.6 \times 10^3 \ rad/s$

10) In Q8, if high frequency roll-off is -100 dB/decade then calculate the minimum frequency (***1 point***
ω_2) up to which loop shape will have to be preserved.

- ○
  $37.5 \times 10^3 \ rad/s$
- ○
  $37.2 \times 10^3 \ rad/s$
- ○
  $45.2 \times 10^3 \ rad/s$
- ○
  $54.2 \times 10^3 \ rad/s$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$37.2 \times 10^3 \ rad/s$

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